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In nearly every large electronics application, as much or more improvement has resulted from basic systems streamlining than from high-speed data processing

Basic Flow Charting Techniques

by Richard W. Pomeroy

► The feeling is slowly gaining ground among systems personnel that we have perhaps permitted ourselves a bit too much concern with the theory, application and mechanics of electronic computers at the expense of the basic techniques of our profession. Most of us would be hard pressed to remember the last time that the predinner discussions at a chapter meeting centered around how to write and present a good report or what constitutes good interview procedure; it has become much more fun to speculate on the potential uses of a machine which will do, not thousands, but millions of additions a second. The subject of electronics in business is new, romantic and, to varying degrees, practical. Voicing our opinions and our first–, second–, or fifth-hand knowledge of this or that computer makes us a real or vicarious part of this fascinating futuristic world.

It further succeeds in overwhelming our junior brethren who stand about and wonder how any of these knowledgeable masters of the field ever managed to gain access to the facilities which taught them the basic steps up the systems hill.

The vital importance of flow charting seldom is appreciated fully. It is of particular interest as being one of the few devices developed for primary application to systems work. While not our exclusive domain, no other business or scientific discipline relies so heavily on this type of charting as do systems men. The prime use and prime value of flow charting is to organize our own thinking and understanding of complex procedures.

The collection of the thousands of detail facts needed to have a thorough understanding of an operation or project is done by the pick-and-shovel method of asking questions of everyone who knows anything about the job being studied. At this point the interviewer sets aside his lay techniques and becomes a Systems Analyst. He pulls from his hat a fascinating device, a simple procedure which will magically transform some 20,000 spoken words abbreviated into some 21 pages of written notes into one single roadmap of a complete clerical op-

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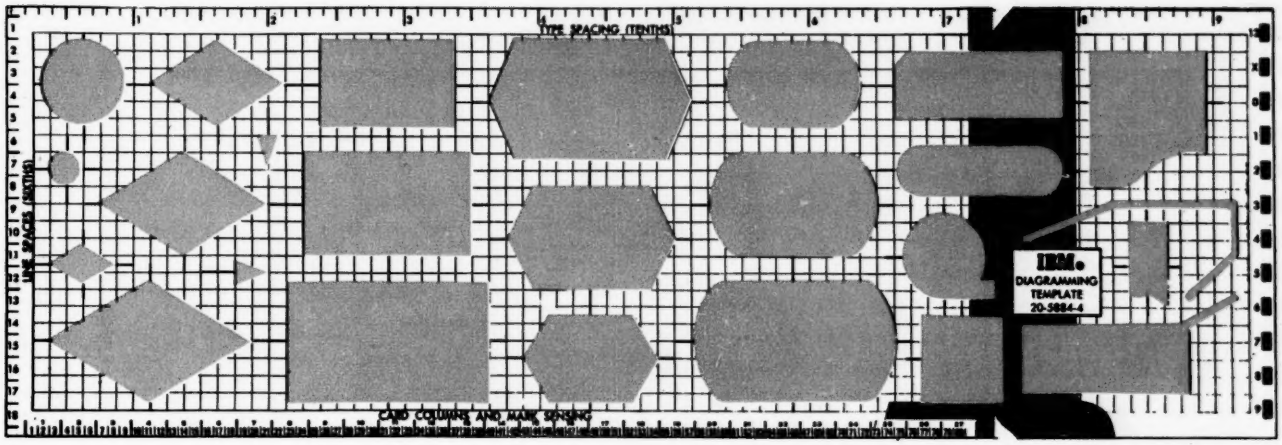


FIGURE 1.

eration. Prior to the roadmap, the systems man's head contained a large cloud of completely disconnected details. As the map is assembled, each detail is pulled from the pile and put into its proper place and perspective. On completion of the drawing the mass of mental detail has been arranged to form a compact area of complete comprehension.

A very important part of this comprehension is that in seeing "How" the thing is done we come to understand a great deal of the "Why." We sense—usually see on the chart, though occasionally we refer admiringly to a man who can "smell" or "feel"—areas of potential improvement. The investigation begins to take on direction, phase two of our flow charting story.

These two phases constitute by far the greatest value of the flow charting method. Beyond this point flow charts, while of great usefulness, are of diminishing importance.

Other flow chart uses need not be labored here. We use them for reference to check forgotten details; where our lines do not terminate satisfactorily they indicate details needed but missed. They are used to explain a job to someone else, frequently to the person doing it to impress upon him the magnitude of his job. They are simplified to form a basis for a presentation to key men; they are explained to instill management confidence in the thoroughness of our approach and the validity of our recommendations. They are drawn into procedures manuals. Flow charts are, in a word, very very important.

The methodology of flow charting is as simple as it can be: we use symbols to represent pieces of material or events and we connect the symbols to indicate a time (implying a sequence or travel) relationship. A flow chart generally portrays only two things: operations, both clerical and machine, and forms. In some special purpose flow charts, for example the Schematic Flow Diagram, machines are pictured to better describe an operation; similarly files or furniture may be portrayed for a particular purpose. On most flow charts however machines are implied from a machine-operation symbol (e.g., the Accounting Machine operation symbol on the IBM template) or from a word description accompanying a general operation symbol, (e.g., the word "Type" which implies the use of a typewriter). It is also interesting to note that the symbols titled "Permanent File" and "Temporary File" in most conventions are not intended as files but as infiling or outfiling questions.

continued

The simplicity of the flow charting method results in a versatility limited only by imagination; we can chart anything that moves through time. This versatility has resulted in thousands of different uses of the technique. From these many applications come some charts which we describe as special-purpose flow charts and others sufficiently far removed from the basic application to deserve special titles of their own. And from this wide application also comes a confusion of terminology and a profusion of symbol conventions.

Standardization Needed

Regarding terminology we need only remark that we would all benefit from some standardization. As for symbol conventions we note that no one has as yet been able to devise a generally acceptable set of symbols which would cover the entire range of application. The American Society of Mechanical Engineers convention, using a circle, square, triangle and an outline letter D, is in wide use but suffers from oversimplification. The template of charting symbols put out by a large office equipment manufacturer, IBM, is probably the nearest thing we have to an accepted standard (Figure 1.) There are two reasons for this: it is an intelligent answer to the problem; and the template is available free from any of a very large number of widely distributed salesmen. It seems unlikely that anything will better the IBM template in the immediate future.

Adapt Symbols

The objective here is to stress the point that no single charting convention is satisfactory for all needs. For maximum clarity of presentation it is vitally necessary to keep an open mind and to adapt the symbols to the requirements of what we're trying to describe. Any convention will, with a bit of imaginative squeezing, fit 97% of your charting needs. The remaining 3% can mean the difference between confusion resulting from trying to bend a description to fit a symbol not capable of conveying it, and a simple straightforward pictorial representation.

The flow chart presented as Figure 2 is, for the most part, of standard composition. It is a simulated procedure intended to illustrate a handful of slightly unusual symbol treatments which deal with unusual situations. The symbol convention used is that of the IBM template. This convention is particularly well suited to portraying punched card operations (for which it was designed). The solid flow lines on the chart show the progression of documents, and the broken lines represent the transfer of information, as in a posting from one document to another, or the creation of a new document. This treatment of flow lines is clear and simple and seems to be the one in widest use.

Mechanics

A word about the mechanics of the chart. All symbols, lines, and arrowheads on the chart were made up from pressure-sensitive tapes and printed symbols, in this case those made by Chart-Pak, Inc. It may be noted that the broken flow lines are actually wider than the solid lines to show up equally as strong. The original of the chart was constructed 2½ times the final size to permit the use of standard size symbols and typwritten text. The original was then reduced to its final size at some sacrifice of legibility, the reduced type being substantially smaller than 5-point type, the smallest print standard (a printer's point is 1/72nd of an inch). Major headings were put together on the original chart from sheets of large letters printed on cellophane. The circled letters in the body of the chart refer to areas which are discussed in the text of the article and reproduced there.

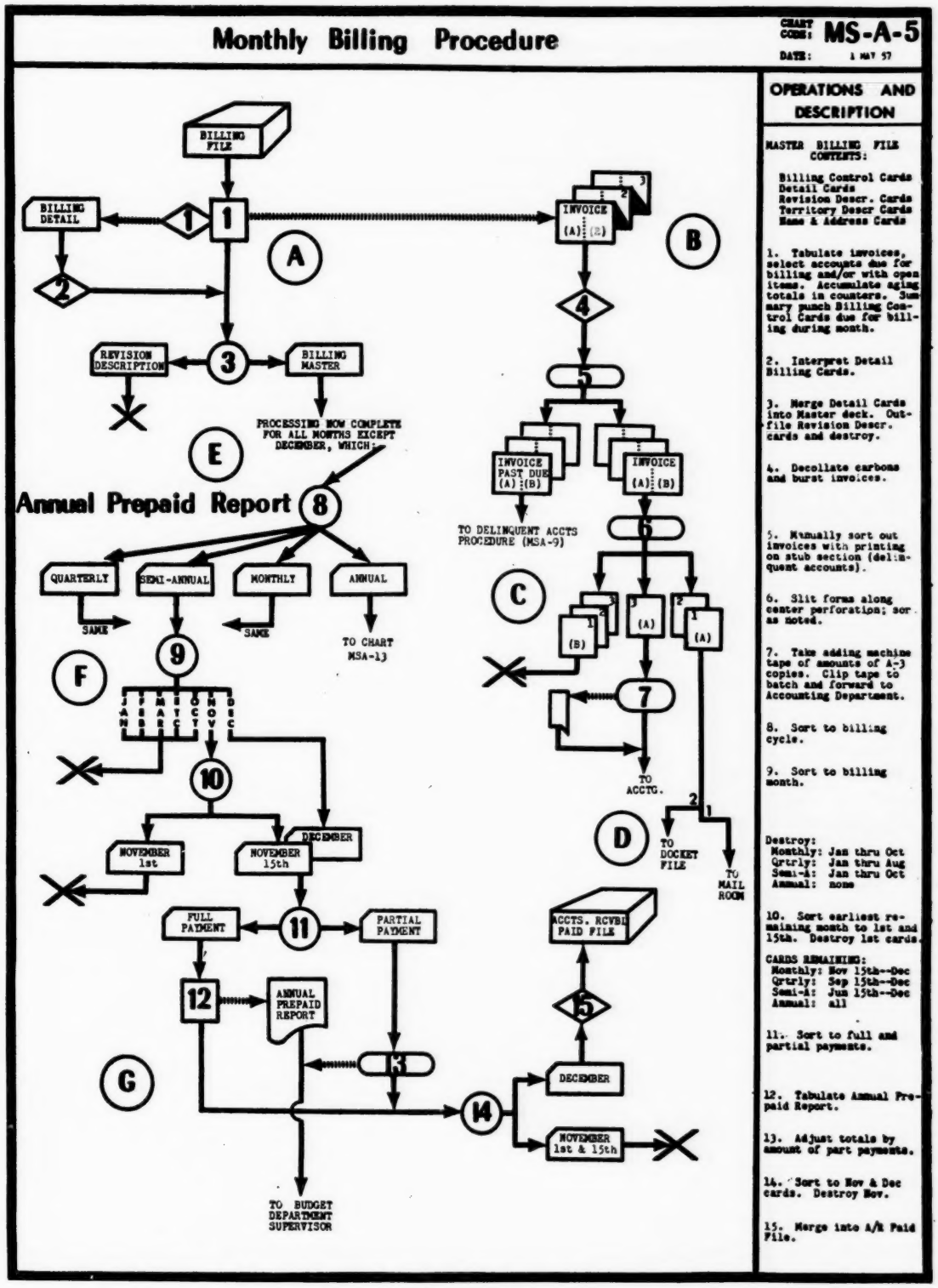
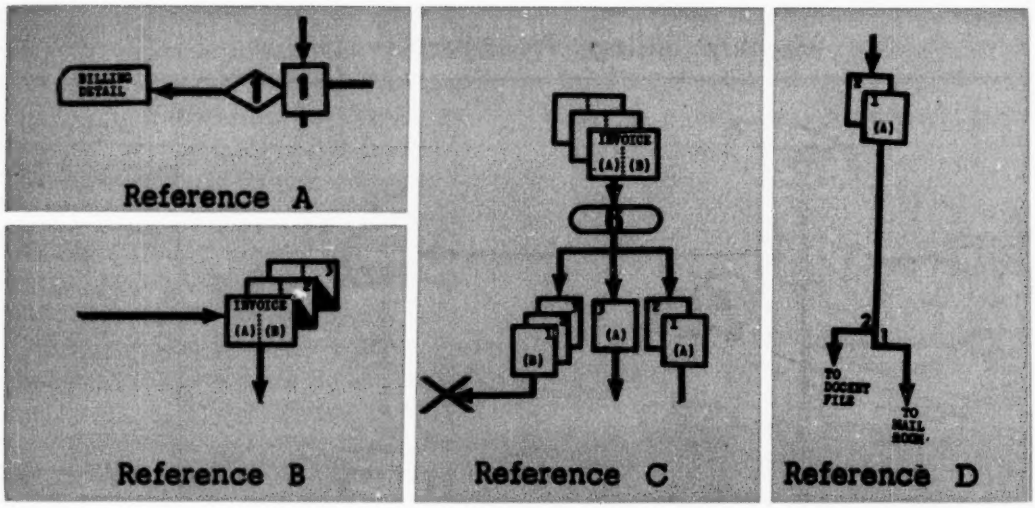

Monthly Billing Procedure
CHART CODE: MS-A-5
DATE: 1 MAY 57
OPERATIONS AND DESCRIPTION
BILLING FILE
BILLING DETAIL
REVISION DESCRIPTION
BILLING MASTER
PROCESSING NOW COMPLETE FOR ALL MONTHS EXCEPT DECEMBER, WHICH:
Annual Prepaid Report
QUARTERLY
SEMI-ANNUAL
MONTHLY
ANNUAL
SAME
SAME
TO CHART MSA-13
INVOICE
INVOICE PAST DUE
TO DELINQUENT ACCTS PROCEDURE (MSA-9)
TO ACCTG.
TO DOCKET FILE
TO MAIL ROOM
NOVEMBER 1st
NOVEMBER 15th
DECEMBER
FULL PAYMENT
PARTIAL PAYMENT
ANNUAL PREPAID REPORT
ACCTS. RCVBL PAID FILE
DECEMBER
NOVEMBER 1st & 15th
TO BUDGET DEPARTMENT SUPERVISOR
A
B
C
D
E
F
G
MASTER BILLING FILE CONTENTS:
Billing Control Cards
Detail Cards
Revision Descr. Cards
Territory Descr Cards
Name & Address Cards
1. Tabulate invoices, select accounts due for billing and/or with open items. Accumulate aging totals in counters. Summary punch Billing Control Cards due for billing during month.
2. Interpret Detail Billing Cards.
3. Merge Detail Cards into Master deck. Outfile Revision Descr. cards and destroy.
4. Decollate carbons and burst invoices.
5. Manually sort out invoices with printing on stub section (delinquent accounts).
6. Slit forms along center perforation; sor as noted.
7. Take adding machine tape of amounts of A-3 copies. Clip tape to batch and forward to Accounting Department.
8. Sort to billing cycle.
9. Sort to billing month.
Destroy:
Monthly: Jan thru Oct
Qrtrly: Jan thru Aug
Semi-A: Jan thru Oct
Annual: none
10. Sort earliest remaining month to 1st and 15th. Destroy 1st cards.
CARDS REMAINING:
Monthly: Nov 15th--Dec
Qrtrly: Sep 15th--Dec
Semi-A: Jun 15th--Dec
Annual: all
11. Sort to full and partial payments.
12. Tabulate Annual Prepaid Report.
13. Adjust totals by amount of part payments.
14. Sort to Nov & Dec cards. Destroy Nov.
15. Merge into A/R Paid File.

FIGURE 2.

continued



Reference A on the chart is a combination of the Accounting Machine and the Auxiliary Machine symbols and is intended to illustrate that a summary punch is cable connected to a tabulator. Both symbols carry the same operation reference number on the chart indicating a single machine-sequenced operation.

Reference "B" is intended to portray a continuous invoice form of three parts with interleaved carbons. Such pictorial treatment is useful under some circumstances; for example, to highlight a before-and-after situation. Similar variations can be adapted to fit a number of special-purpose forms. This type of form could, alternately, be shown as a regular multiple copy form with every other copy shaded to indicate carbons. The invoice shown is perforated in the center and the two halves are lettered to permit tracing through the routing which follows. Similarly the copies of the invoice are numbered. After the form is burst and decollated it is separated manually into its two halves at operation 6.

In the distribution, (Reference C) the three "B" copies are destroyed as indicated by the large X. A completely satisfactory symbol for destruction has not yet been devised, probably because no convention has suggested a mnemonic symbol which can be drawn simply. The large X is in wide use as suggesting "X-ing out" or crossing off. Part A3 of the invoice set is now taped on an adding machine, operation 7, and leaves the chart to be picked up on another chart.

Reference D is a distribution symbol used to separate the paths of copies of the form. This distribution convention is particularly versatile. It is based simply on numbering each copy of a multiple-part form and correspondingly numbering the lines as they break away from the main flow line. It can be used to show a complex routing of an unlimited number of copies in a compact space.

Operations 3, 8 and 9 portray three different sorting conventions, the horizontal, diagonal and vertical. The first two (Reference E) are simple sorts. The advantage of the horizontal is a saving in space on a vertically drawn chart; this space saving is obvious from a comparison of the horizontal with the diagonal.

The vertical sort symbol (Reference F) or "sorting rake" permits the portrayal of a very complex sort in a minimum of space.

In this case the January through October cards are destroyed. The November cards then go through an additional sort to separate the 1st from the 15th cards. The former are then destroyed and the latter are joined by the December cards from above to be sorted to full and partial payments. The other three classes of cards, Quarterly, Semi-annual and Annual billings, are subjected to slightly different processing after the first sort to month; this is explained in the text. The rake symbol is here squeezed into a very tight space to point up its compactness. It is further abbreviated through the use of vertical print for the month names and the use of the word "ETC" to replace the months between March and October.

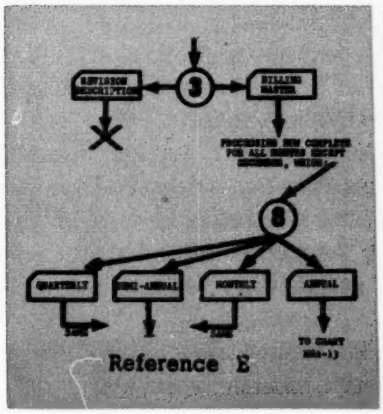
After the full and partial payments are separated, the former are tabulated to the Prepaid Report and report totals are adjusted by the amount of partial payments.

The report then proceeds (Reference G) to cross the main flow line, a complication which should be avoided where possible. The main flow line then turns across the page and up, a bad practice which tends to confuse but which was resorted to here to get the entire procedure on one sheet.

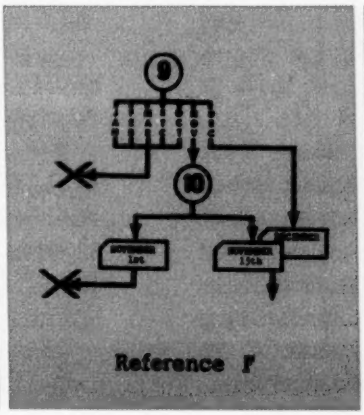
The chart areas discussed are a small sampling of the ways in which the standard approaches to charting can be varied to produce special effects. For flow charting to achieve its widest application and optimum value, we must proceed in the direction of making imaginative use of simple symbol standards.

The opposite extreme of this is to assign a different symbol to every operational condition, clearly an impossible task. The validity of using a small number of symbols which can be combined and varied to portray different conditions is borne out by the attempt of one government agency to develop enough symbols to cover almost all situations. More than a hundred symbols were designated and intended (with only limited success) to suggest the operations they represented. Aside from the complications of using such a large battery of symbols and the ambiguity which is bound to result from borderline operations, the important advantage of being simply understood is completely lost. We have only to review the uses which flow charts serve to appreciate the importance of simplicity of understanding. We cannot expect an unfamiliar person who is probably little interested to begin with, to refer to a tedious list of symbol meanings, nor can we devote half the chart page to lengthy expanatory legends.

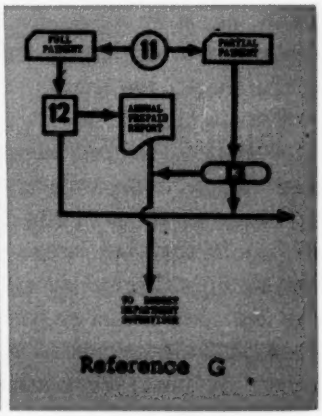
It is not too far amiss to think of the systems profession as stemming in large part from the development and refinement of the flow chart as a simple, effective and



Reference E



Reference F



Reference G

continued

specialized working technique. In this age of electronic logic it is interesting to note that the basic flow charting device has lost very little of its relative importance. In the multifarious writings on computer applications one vitally important fact is frequently repeated and almost as frequently ignored: In nearly every large electronics application, as much or more improvement has resulted from basic systems streamlining than from the high-speed processing of data. Carefully considered, such comments suggest quite strongly that perhaps the basic systems job is not being handled as well as it might be. In back of every Logical Diagram drawn to assist the computer programmer are an awful lot of plain old Flow Charts. **s/p/a**

NO. 11 OF A SERIES ON A MANAGER'S STAKE IN SYSTEMS

Command Work

by Leslie Matthies

► What is the first step in any organization analysis work? Isn't it to determine the reason for the existence for each part of the organization, which is the work it does?

Normally most managers divide work into two categories:

1. *Direct Work.* This is the work that is the main reason for the existence of the organization. In a factory this would be the work actually done on the product.

2. *Indirect Work.* This is work that is not performed to manufacture the product. Indirect work is a support, or a service to the direct work. Such work includes accounting and various services such as internal mail systems, the maintenance man, the carpenter, the electrician, etc.

All work cannot be divided into either direct work or indirect work. There is another kind; the work of command. If we sort work in three categories, instead of two, we change our entire viewpoint and alter our approach to organization analysis.

As it is now in our organization analysis we drop all our command functions in the indirect category. We mix up management functions with service functions. So let's sort work into three classifications: (1) *Direct,* (2) *Indirect,* and (3) *Command.*

What work should we include under the command function? Certainly we include the work done by men assigned to run a group or a department. This includes the leadman, assistant supervisor, supervisor, general supervisor, manager, and even the work of the vice-president. These men direct other people, make decisions, develop policy, control and coordinate work.

What else should be included in the command category? Such work as administrative planning, control and reporting. We should include administrative systems; budgets and work authority control; and whatever intelligence reports set-up the organization needs.

With command work set apart, we can do some analyzing. What is the command ratio to direct work? To indirect work? To both? The amount of command work often is surprisingly high—20%, 25%, sometimes higher. What should it be? What is it in competitive industries?

Perhaps there isn't enough command work. Then planning suffers. Perhaps many men paid to do command work actually are doing support or service work. Sometimes vice-presidents spend two hours opening the morning mail.

So we have three kinds of work: direct, indirect, and command work. **s/p/a**

Program maintenance and system follow-up, generally a forgotten area, is a full-time job at Ford Motor Co.

The Importance of Program Maintenance

by John Boccomino

► A great deal of attention has been focused on practically every facet of computers, ranging from feasibility studies to a step-by-step procedure for the installation of a computer. Very little mention, however, has been made of how often and how much program maintenance work is involved for a business application after it has been successfully installed.

Recognizing that the amount of program maintenance will vary with the type of application, perhaps some idea may be obtained by relating the experience we have had at Ford Motor Company concerning the maintenance of our Hourly Payroll programs.

In March 1956, Ford Motor Company began utilizing a 702 IBM electronic computer to process the hourly payroll. Currently approximately 70,000 hourly employes are paid weekly with the computer system. Several separate programs with an aggregate total of approximately 13,000 instructions are utilized in the system.

Two major programs, i.e. Payroll File Maintenance and Payroll Processing, are illustrated in the general flow chart. Very briefly, the File Maintenance program, as the name implies, performs all of the normal record maintenance functions found in any type of record keeping. It is able to remove terminated records, change any data carried in the record, such as badge number, hourly rate, various authorized weekly and monthly deductions.

The Payroll Processing program concerns itself primarily with the calculation and preparation of checks, payroll registers, the distribution of hours and money, and the updating of the employe's record to record his current quarter and year-to-date earnings.

To complete our complement of programs constituting the 702 system, we have

John Boccomino is in the payroll and computer systems development section of Ford Motor Company. He leads a two-man team responsible for maintenance of computer programs used in processing the company's hourly payroll.

continued

in addition to the two previously mentioned major programs, a quarterly tax program, vacation accrual, and special payroll reports programs.

Program maintenance activity on such a system, performed less frequently as the system was progressively perfected, was traced to five general causes:

1. Undetected Program Errors

Although debugging of the program was extensive, it was not possible to predict all conditions or combinations of factors which could affect the operation of the programs. As a result, during production runs on the computer, intermittent errors periodically came to light as inadequate output was generated by the 702. In many instances the error was so subtle that several days were spent in isolating the trouble.

A typical example occurred in the File Maintenance program. As a by-product of maintaining a current master tape, this program generates detail for the central mailing file each time an address change, new hire, or termination is processed. We discovered that each time an address change, new hire, or termination was processed, this detail was not generated (put out) 100% of the time. Investigation of the computer output revealed a definite pattern of omissions. A check of the program instructions revealed that it was inadvertently omitting the creation of this output data each time the following combination of transactions was made for a single employe record:

A. Process a badge number change (Upon detection of a card punched with a significant code as well as the old and new badge numbers)
B. Process a Blue Cross Insurance deduction (Automatically "triggered" once a month upon recognizing a proper Blue Cross code in the master record together with identifying a predetermined console switch setting)
C. Process a change of address (Upon detection of a second card punched with a specific code and new address)

Because these three conditions for one record seldom occur at the same time, several weeks of processing had taken place before this defect in the program was brought to our attention. It is common to detect errors of this nature even after many months of successful operation.

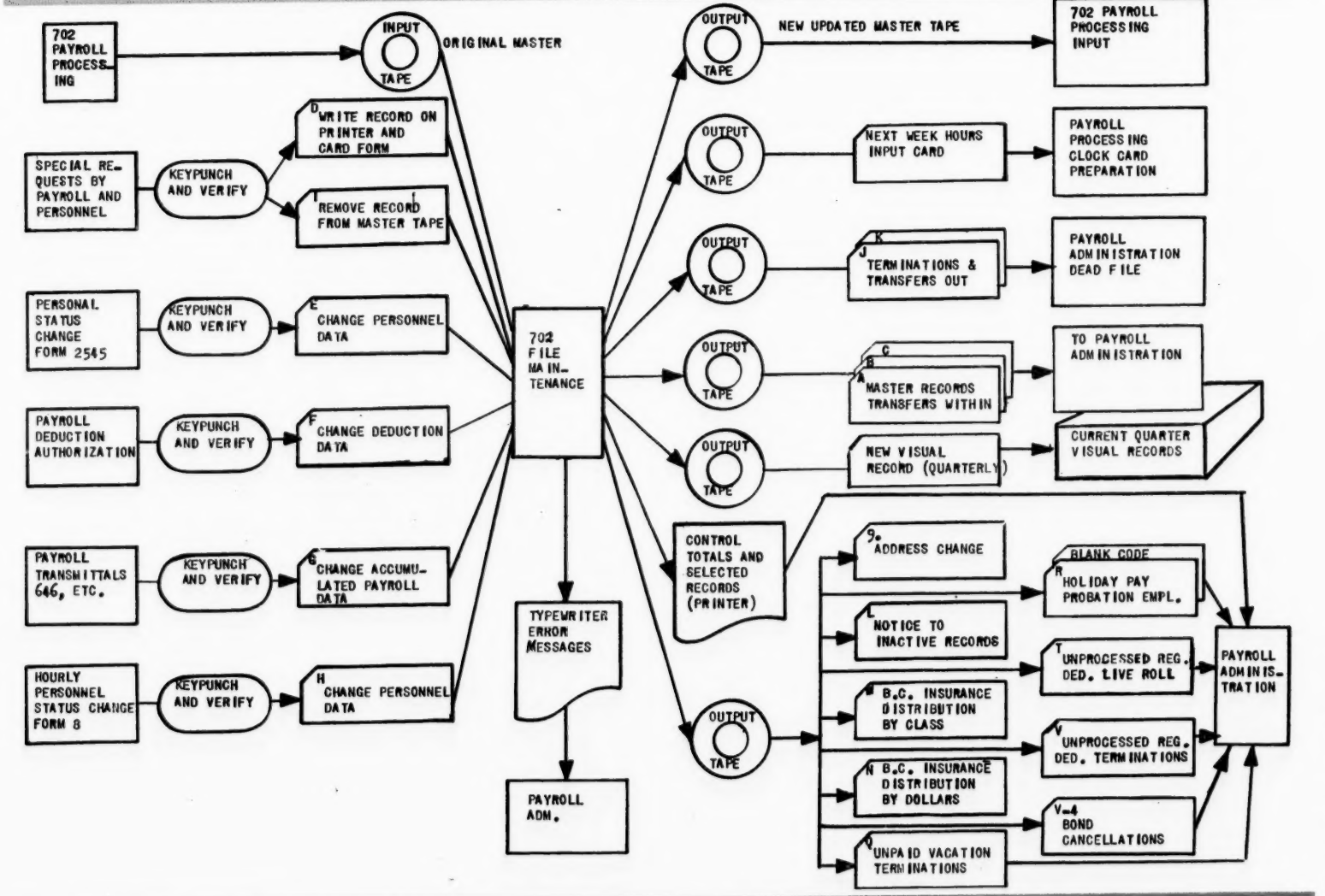
2. Incorrect Input Data

In our experience, one of the major causes of trouble encountered in a computer installation is incorrect input information, generally in the form of punched cards. Whenever the clerical force questioned the validity of certain output information or the lack of positive computer action on a given record, investigation would generally prove that the source of trouble was improper input data. Three courses of corrective action are open when the source of error is identified:

A. Place a tighter control on the clerical operation which originates the data.
B. Perform machine edits on input data prior to 702 processing.
C. Incorporate into the 702 programs the ability to detect and by-pass the errors.

Although we provided mechanical edits as well as some 702 programmed error detection routines, a few input errors were still getting into the system, resulting in time-consuming stops on the computer. In many instances the source of trouble cannot be identified immediately or related to input errors. A classic example of this type of error condition occurred when an employe master record was in the system several weeks before giving any positive indication that it carried an improper code. This erroneous code was modified each week until it finally became a character of

General Flow Chart, Hourly File Maintenance, Utilizing IBM Model 702 electronic data processing machine


702 PAYROLL PROCESSING
INPUT TAPE
ORIGINAL MASTER
SPECIAL REQUESTS BY PAYROLL AND PERSONNEL
KEYPUNCH AND VERIFY
D WRITE RECORD ON PRINTER AND CARD FORM
I REMOVE RECORD FROM MASTER TAPE
PERSONAL STATUS CHANGE FORM 2545
KEYPUNCH AND VERIFY
E CHANGE PERSONNEL DATA
PAYROLL DEDUCTION AUTHORIZATION
KEYPUNCH AND VERIFY
F CHANGE DEDUCTION DATA
PAYROLL TRANSMITTALS 646, ETC.
KEYPUNCH AND VERIFY
G CHANGE ACCUMULATED PAYROLL DATA
HOURLY PERSONNEL STATUS CHANGE FORM 8
KEYPUNCH AND VERIFY
H CHANGE PERSONNEL DATA
702 FILE MAINTENANCE
TYPEWRITER ERROR MESSAGES
PAYROLL ADM.
OUTPUT TAPE
NEW UPDATED MASTER TAPE
702 PAYROLL PROCESSING INPUT
NEXT WEEK HOURS INPUT CARD
PAYROLL PROCESSING CLOCK CARD PREPARATION
J TERMINATIONS & TRANSFERS OUT
K
PAYROLL ADMINISTRATION DEAD FILE
A B C MASTER RECORDS TRANSFERS WITHIN
TO PAYROLL ADMINISTRATION
NEW VISUAL RECORD (QUARTERLY)
CURRENT QUARTER VISUAL RECORDS
CONTROL TOTALS AND SELECTED RECORDS (PRINTER)
9. ADDRESS CHANGE
BLANK CODE
R HOLIDAY PAY PROBATION EMPL.
L NOTICE TO INACTIVE RECORDS
T UNPROCESSED REG. DED. LIVE ROLL
M B.C. INSURANCE DISTRIBUTION BY CLASS
V UNPROCESSED REG. DED. TERMINATIONS
N B.C. INSURANCE DISTRIBUTION BY DOLLARS
V-4 BOND CANCELLATIONS
U UNPAID VACATION TERMINATIONS
PAYROLL ADMINISTRATION

continued

a type which inadvertently caused significant computer action. Only by reconstructing manually all conditions and computer operations performed on this record were we able to account for the code characteristic at time of detection and the consequent action taken by the computer. Cases such as this compelled us to make additions to the program that would eliminate recurrences of this nature.

3. New Situations

With the gradual acquisition of new rolls to be processed on the computer, new and unanticipated situations were introduced to the system that required additional modifications to the programs.

For example, our File Maintenance program contains a series of instructions that verifies each employe's record entering the computer to insure that the hourly rate contained in each record falls within a specified minimum and maximum range. Recently we began paying a newly built plant where the rates did not fall within the acceptable range stipulated by the program. This caused the 702 to generate pages of rate error notices. In this simple case, some computer time was wasted by writing these false error messages, which were eliminated quickly by a slight revision to the program. However, depending on the type of computer action brought about by unanticipated conditions, the consequences could have been much worse and might have necessitated numerous revisions to the program.

Due to the fact that the processing in a computer system takes place in a manner which is not perceptible by vision, a good deal of attention must be given to seemingly minor procedural changes. Even the slightest deviation may have an adverse effect on the computer system. In all cases, the program should be analyzed to determine what program changes, if any, are required to cope with the situation

4. Fuller Utilization of the Computer

In most computer systems, certain phases of the clerical operation are not programmed initially, either by conscious omission or oversight. Hence, after the system is functioning smoothly, efforts are made to incorporate additional functions which ease or eliminate clerical trouble spots or provide additional information in report form for management.

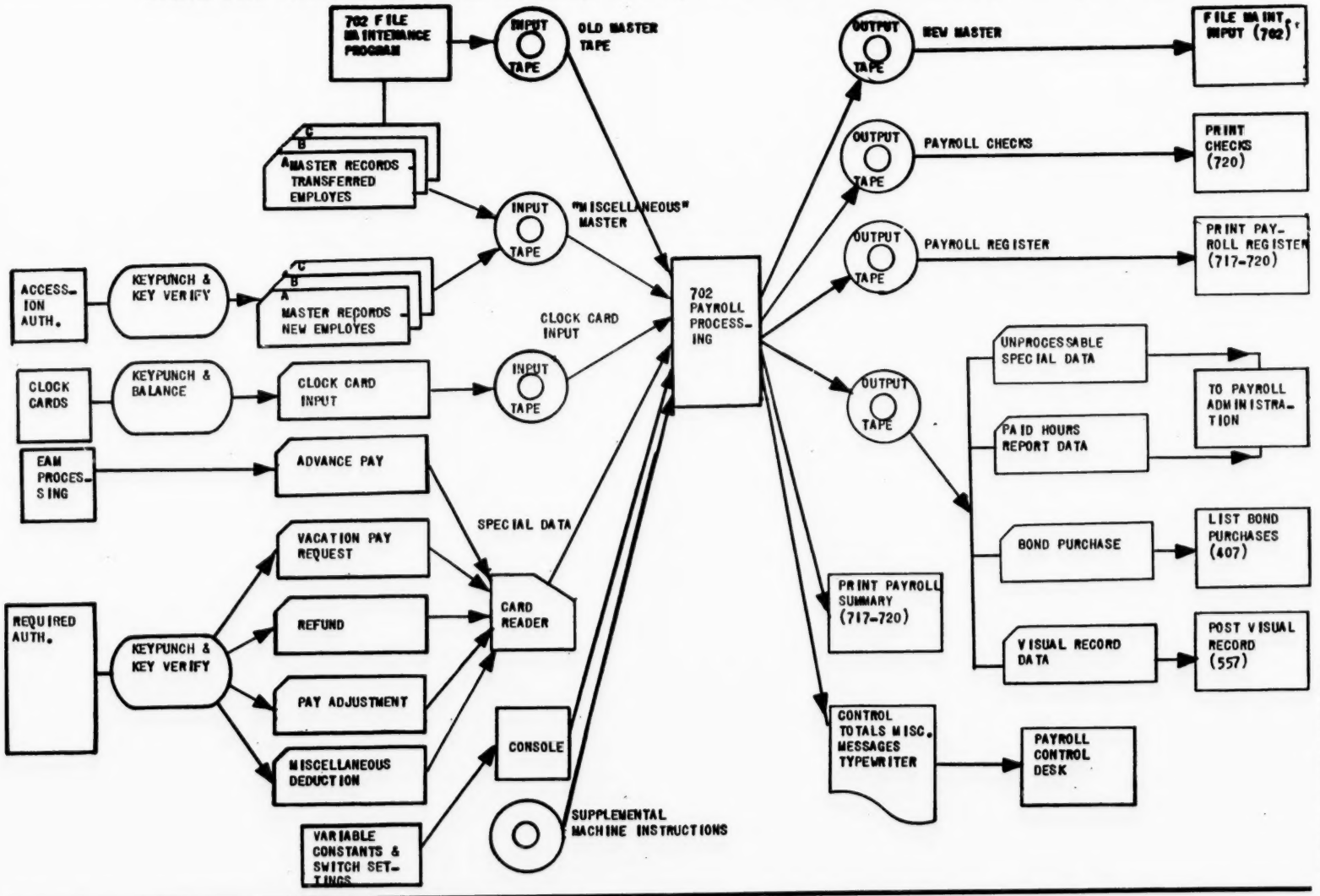
Examples of this activity range from the simple insertion of a few instructions to provide for automatic printing of the pay ending date at the top of each register page, to more elaborate modification of the program. Two such revisions to the program provided statistical reports and automatic payment of holiday pay. The latter example brought relief to the keypunch section and reduced the need for clerical determination of holiday pay eligibility, based on seniority.

5. Dynamic Nature of the Application

The Payroll Programs always will be subject to constant revisions due to the numerous changes in Company policies, new union contracts, Government regulations, etc. Following are a few examples that we have experienced already:

A. *Supplemental Unemployment Benefit Plan.* This plan, negotiated between the union and the Company, supplements the normal unemployment compensation benefits. Because this plan is associated closely with the number of hours an employe works in any one week, it became a payroll responsibility. As such, we were required to incorporate certain processing phases of this plan into the existing payroll programs.

General Flow Chart, Hourly Payroll Processing, Utilizing IBM Model 702 electronic data processing machine.



continued

B. Annual Improvement Factor. Once a year, under the present union contract, each employe receives a rate increase. The amount of increase is arrived at by using an applicable formula for each classification. Since the effective date for this annual rate increase falls on a different day each year, the program must be modified annually to compensate for this difference.

C. Semi-Annual Changes in Group Insurance Premium. Since the insurance premium rates are an integral part of the employe's master tape record, twice a year revisions to the program were made to process insurance rate changes. (Recently we have provided for automatic recognition by the computer to process these rate changes without revising the program each time a rate change was required).

D. Social Security Withholding Rate Change from 2% to 2¼%. This, of course, affected our net pay computation, and required a simple program change.

In conclusion, the numerous additions and changes made to the payroll programs add up to 3550 computer instructions in less than one year. The payroll processing program has grown from 3300 instructions to 4150 instructions, an increase of 20 per cent. The payroll file maintenance program has grown from 2500 to 3250 instructions, an increase of 23 per cent in program size. As a result of these numerous changes, the payroll was processed with a new program about every other week for the first ten months of operation.

Although program maintenance and system follow-up activity is generally a forgotten area, it has proven to be a full time job. **s/p/a**

Please send any communications regarding SPA to national headquarters at 4463 Penobscot Building, Detroit, Mich.

by Gerald P. Grant and Robert E. Sellers

Effective Systems T

► Like most Systems Departments, we too periodically performed the self-evaluating function of "Where do we stand?" in company service. The usual approach was from the standpoint of improvement in communications, selling, installation, etc. However, the feeling persisted that in spite of our efforts, somehow we were dragging our feet—*we were not keeping up with a growing company's needs for systems changes.*

While realizing that we were not "keeping up," it was nonetheless startling to hear the supervisor say, "Then let's get ahead of present needs." It sounded impossible, but we were asked to:

1. Provide one tool that would permit systems change to be integrated in advance with future operations.
2. Recognize the need for "brush fighting" only on request and for immediate remedial needs.

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Systems is an ever-changing philosophy; today's theories will be tomorrow's principles and tomorrow's principles may well be obsolete the following day

s Through Long Range Planning

Specifically, this tool for future systems design was to incorporate the following features:

1. Be so designed that it could be integrated readily into management approved forecasts.
2. Permit systems design for the future which would erase the old barb of "change for change sake" or "this has worked for X years, why change now?"
3. Furnish a systems design that would be the basis for future organizational and manning needs.
4. Furnish a basis adaptable to technical developments in paper reporting and analysis output.

Usually the first work of any newly organized administration is confined largely to corrective action, in remedying a legacy of particularly troublesome organizational and operational problems—and so has it been with systems. True, there have been numerous developments in the field of systems, such as the concepts of work simplification, clerical performance standards, integrated data processing, and more recently, electronics, many of which are in successful operation today. However, their application has, for the most part, stemmed from current problems; thus, whether major systems installations or minor methods innovations, they are still in reality, "fire-fighting" or short range considerations. And so they will remain until the basic philosophies of systems undergo some radical but very necessary changes, which will provide the basis for effective systems through long range planning.

Systems, as we recognize it today, has but a single purpose, which simply stated, can be reduced to a single word: improvement. Translating it further into more specific terms of our activity, this improvement is generally directed toward streamlined performance, increased margin of profits, and maintenance of effective controls over operations.

By themselves, these objectives or any others you may choose to substitute, for that matter, certainly are desirable targets. But conversely, *by themselves*, and particularly in terms of present short range considerations, they are wholly inadequate. Systems should be considered akin to a science: as such, underlying even the stated objectives for improvement is the fact that,

continued

like our sciences, systems is an ever-changing philosophy. Today's theories will be tomorrow's principles; and tomorrow's principles may well be ancient history and obsolete the following day.

Systems have fallen short of their true objectives in spite of the introduction of numerous technological advancements. They are still inherently defective because:

1. Systems are established, evolving around either personalities or special abilities, and therefore, are not impersonal.
2. Systems generally do not have the flexibility to lend themselves to changes in character of business operations.
3. More often than not, systems fail to provide for addition and growth of either functions or business itself.
4. Systems often "bog down" at the merest mention of changes in physical location, which are increasingly prevalent in this era of changing market trends and sources of material and labor.

Actual Cases

Short of mastering the art of crystal-gazing, it would appear virtually impossible to design systems having the flexibility to stay ahead rather than keep up with the business. And yet, crystal-gazing, based on, and supplementing a realistic and logical interpretation of business trends, is no more far fetched than sales forecasting, budgeting or production planning, which seemed equally far fetched only yesterday.

Although still in its infancy, so to speak, long range planning in systems has already profited users of this new concept. Here are some examples of actual cases, illustrating the potential of long range planning in systems:

Before the advent of long range planning, one company acquired a manufacturing plant. Today, nearly a year after its acquisition, they are still reviewing regularly, then integrating its systems and procedures with the over-all pattern of operations, on a come-and-go, "fire-fighting" basis.

On the other hand, they presently are in the process of expanding manufacturing operations in another area of the country. Although these manufacturing facilities are not yet completed, the systems department is already actively engaged in the development and implementation of their systems and procedures, and will integrate them with the master company plan, immediately upon commencement of operations, with no subsequent modification or "fire-fighting" activity required. In fact, not only have they been participating actively in this program since management's decision to expand, but also, thus appraised, they are now in a position to install advanced systems and procedures, which are programmed for company-wide introduction at a later date.

A second company is in the process of constructing new office facilities, resulting from growth and expansion of operations. While still in the planning stages, studies were made of paperwork flow which, coupled with present and future personnel growth and equipment requirements, as well as projected systems activity, is not only influencing the construction of the building itself, but also has resulted in the development of an advance plan for utilization of these facilities, including office and equipment layouts.

Still another company is in the process of installing integrated data processing which will ultimately affect 16 plants, 18 branch offices, and 5 warehouses. Because of the magnitude and scope of operations involved in these projects, one can appreciate the staggering time and systems staff requirements. However, in view of tangible and substantial benefits with rela-

tively little modification required other than in the mechanics of paperwork methods, they are proceeding on a limited scale, extending the I.D.P. application to only those areas which at this time afford the greatest and immediate potential. However, by direction of executive management, a committee has been formed, representing every area of operation, for the express purpose of implementing this program with provisions for conformance with a long range, master plan, encompassing the full scope of operations. This committee, working in cooperation with the systems project staff, is fully empowered to make such decisions for their respective divisions as will enable and insure the successful application of this system, whatever its ultimate coverage may be.

These and other benefits, which could be similarly elaborated on, are classic examples of long range planning in action. Three ingredients are required to make such a program possible:

1. The understanding, complete agreement, and unequivocal support of executive management.
2. The full cooperation of all levels of supervision, throughout every operating area of the company.
3. The time and combined effort of the systems function in the development, formulation, and application of the long range plan.

Systems Questionnaire

The basis for long range planning is depicted in the exhibit entitled "Long Range Planning Systems Questionnaire." (Illustrated on pages 16-17) Note that, aside from certain specific details which are characteristic of the paper industry, the general pattern, as well as the questions themselves, can readily be applied to any company. This questionnaire, then, going back to the three ingredients for long range planning, is the result of the time, thought, planning and effort on the part of the systems department.

Line Operations

The next, and perhaps most obvious observation is that the questionnaire is, after all, only a questionnaire, which by itself, is otherwise worthless. Here's where the second ingredient comes in. In referring back to the questionnaire, you will note that it relates entirely to line operations; as such, it must, of course, be answered by line supervision. To insure equal consideration of all phases of operations in the subsequent evaluation and application of the questionnaire, every operating area of the company must be contacted, and must participate on an equal basis in completing this important requisite of long range planning.

Finally, and most important, no venture into a concept as significant and far reaching as long range planning could hope for even the slightest measure of success without the full support of top management, who of course, make the major policy decisions which will steer the course of your company's progress.

The primary consideration for long range planning, whether systems-wise or operational, must of necessity center on the basic objective of any company, namely the salability of a product (or service) at a profit. The focal point for coordinating this information in our company is the profit planning section of our budget department which is in the controller's division. Thus, by using the long range coordinated forecasts of our budget department, we are integrating our source data. Following this reasoning then, the questionnaire is based on four key questions relating to product sales:

1. What products are we going to sell?
2. How much are we going to sell?
3. Where are we going to sell them?
4. How are we going to sell them?

KEY QUESTION	SALES	MANUFACTUR
WHAT PRODUCTS ARE WE GOING TO SELL?	1. What products will we sell, and in what proportion will we sell them? a. stock products b. food packaging c. other (1) pulp, paper (2) chemical (3) packaging machinery (4) new products (5) all other 2. What will our position be in research and development of new products, especially as they relate to competitive market trends? a. paper products b. plastics c. metals (foil) d. other	1. What are the items of product desired?
HOW MUCH ARE WE GOING TO SELL?	1. What is our projected $ sales forecast? 2. What will our resultant unit order volume be, according to classification? a. stock products b. orders manufactured to customer specifications c. all other	1. What is the desired volume of each it 2. What is the basic policy as to class a. items manufactured to stock b. items manufactured to custom c. items to be purchased
WHERE ARE WE GOING TO SELL THEM?	1. Who are we going to sell to and in what proportion are we going to sell? a. jobbers b. food packers c. supermarkets d. retail trade e. other sales outlets 2. Where are these markets predominately located? 3. What is the relationship of our consumer market to manufacturing facilities? 4. What is our position in relationship to expansion of sales into foreign market? a. where b. in what proportion to domestic sales	1. Where are the products to be manufac a. present plants - present faci b. present plant - with modific c. projected plants (1) what is labor availab skills required? (2) what is union relatio (3) what is relationship (a) market outlet (b) raw material (c) utilities and (d) transportation 2. What type equipment and machinery w a. manual b. mechanical c. automatic 3. What type physical arrangements and utilized? a. in line or process b. separate or class of process
HOW ARE WE GOING TO SELL THEM?	1. What will the basic structure of our sales organization be? a. end product b. retail outlet c. geographic region (1) territory (2) producing plants 2. How will sales operations be carried out? a. centralized b. decentralized c. centralized - decentralized 3. What service sales functions will be required to supplement field selling activity? a. sales service b. sales engineering c. sales administration d. sales control 4. How will branch and regional sales offices be organized with respect to field selling and home office operations? 5. What will be the basic sales policy? a. high quality, service b. quantity for mass market 6. What consideration is being given to automation in sales operations? a. order handling b. sales reporting c. sales control	1. What are the material specifications? a. by product b. by class of product c. by plant 2. What are the manufacturing processes a. specific operations to be perf b. sequence in which operations c. equipment required to perform d. inventory requirements (1) raw material (2) in process (3) finished goods e. what services are required to production (1) production engineerin (2) production planning (3) quality control (4) operational services (5) purchasing (6) maintenance and repa (7) warehousing (8) traffic and shipping f. how is waste to be disposed 3. What are personnel requirements? a. productive labor (1) skilled (2) semi-skilled (3) non-skilled b. non-productive labor (1) skilled (2) semi-skilled (3) non-skilled 4. What are material requirements?

PLANNING QUESTIONNAIRE

EXHIBIT I

FACTURING	ACCOUNTING	ORGANIZATION
roduct desired?	1. Will the type of products be so diversified as to require individual cost work, or will the types of products lend themselves to standardization? 2. Will the overall volume be spread somewhat equally over the line thus requiring more cost work or will there be high concentration of sales in a few products thus permitting considerable summarization?	
lume of each item of product? cy as to class of manufacture? ured to stock ured to customer specifications chased	1. How much of the projected increase will be due to volume rather than price? 2. What effect will the increased volume have on processing? 3. How much of a volume increase can our present organization absorb? 4. What policy should we follow to handle the excess increase? a. more personnel b. more mechanization c. different system d. decentralization in varying degrees from partial to complete	1. What is the fundamental philosophy of the company? 2. What type of organization? a. functional b. divisional 3. Will we centralize or decentralize? 4. Which operations will be decentralized? 5. Will we set up a business unit organization? 6. Will we be a self-contained business organization? 7. What is the fiscal policy of the company? 8. What is the sales policy of the company? 9. Should we be decentralized on: a. end product b. by product c. geographically 10. Should we have central advisory group?
to be manufactured? • present facilities • with modifications and/or additions es s labor availability as related to required? s union relationship of area? s relationship of plant to: market outlet raw material supply utilities and service facilities transportation nd machinery will be utilized? angements and plant layouts are to be ess ass of process	1. Will volume of sales and production in certain geographic areas suggest the feasibility of a decentralized accounting function in that area? 2. Would decentralization be more desirable with control plants in various area (thus permitting machine accounting) or decentralized into each plant? 3. Will specialty products increase the work load as compared to stock orders? 4. Will foreign sales require a separate accounting function?	
specifications? oduct uring processes to be employed? tions to be performed on each product hich operations are to be performed ired to perform these operations irements aterial cess ed goods are required to sustain planned ction engineering ction planning and services y control tional services - tools and dies asing enance and repair ousing and shipping o be disposed of? quirements? or d skilled killed labor d skilled killed irements?	1. Will we operate with one centralized accounting department? 2. Will accounting organization be decentralized according to a divisional or basic unit organization? 3. If we have a divisional organization will we: a. use regional centralization within a division? b. complete decentralization with regional control? c. complete centralization for all divisions? 4. Will it be more desirable to decentralize, thus using hand methods, or to centralize, thus permitting machine accounting? 5. Will trained personnel be available for decentralization? 6. Will warehousing be a large factor thus causing modifications in accounting practices?	

continued

Answered in all their ramification, and particularly in terms of future operations, such as three, five, or ten years hence, these questions will provide any systems department with a comprehensive operational plan, invaluable for programming, developing, installing or implementing systems projects. Most important, though, it will enable them, for the first time, to install systems with a reasonable assurance of permanency, tailored according to long range company requirements.

Special Questionnaires

Recognizing that uncontrolled, these relatively simple questions would result in a maze of varied and unrelated answers, it was necessary to break the questionnaire down into smaller, more specific components, for integration from long range forecasts. Separate and specific questionnaires were developed according to the individual requirements of each operating division affected, namely: sales, manufacturing and accounting, as well as an organizational section applicable to all areas. That these answers will vary widely is evident in the questionnaire itself. For example, the question, "Where are we going to sell them?" is broken down further according to operating divisions, and then in terms of specific functional interests as follows:

Sales ..... "Who are we going to sell to and in what proportion are we going to sell them? ....."

Manufacturing ... "Where are the products to be manufactured? ....."

Accounting ..... "Will volume of sales and production in certain geographic areas suggest the feasibility of a decentralized accounting function? ..."

This, then broadly outlines the theories of long range planning. To demonstrate the extreme flexibility of this concept, we have selected two actual experiences as widely opposed as possible.

One deals with the determination of space requirements and the physical layout of new office quarters prior to construction. The other is a completely integrated data processing program involving the order-invoicing routines designed for utilization in multi-plant operation.

In the first instance, they were interested in the most effective utilization of space and efficient layout based on the actual work flow. Based upon the various forecasts, plans and objectives disclosed as a result of the questionnaire, it was relatively simple to program the project. The objectives were readily established as

1. To establish a basis for the physical location and layout of the various functions within the accounting division, for the purpose of:
   a. The best balance to facilitate the necessary paperwork and/or information between functions.
   b. The elimination of crisscrossing and backtracking of paperwork by locating each function as close as possible to: (1) its source of data; (2) equipment, services and/or reference sources; (3) the destination of its completed work.
2. Evaluate the relationship of the accounting division with other company areas and the effect of its location on integrated activities.

Based upon the questionnaire projected on a five year basis, the organization and personnel requirements were established. This was integrated into the project for subsequent use in the final determination of space requirements.

Next a complete survey of paperwork was made to establish the flow between functions. To facilitate the study and compilation of data, a key sort card was designed. Of particular interest is the fact

that the card was designed not only to establish and trace paper flow, but also for subsequent application in forms, records and report control programs.

Instructions for uniform compilation, analysis and classification of data were developed, and final analysis and evaluation of the data collected and classified resulted in the physical layout of the office which provided for the best balance of flow and interchange of paperwork between functions.

The second illustration deals with the application of long range systems planning to integrated data processing. This era of highly competitive business accents customer service. To render improved service to its customers, this company is expanding manufacturing facilities to keep abreast of ever expanding markets.

Confronted with a policy of centralized control and decentralized operation, it was of prime importance to shorten the time cycle between the receipt of an order at a central location, the assignment to a specific plant for shipment and its *subsequent same day invoicing back at their central office.*

At first glance, it appeared that expansion of present systems might have solved the problem. However, closer scrutiny of the plans, objectives and forecasts developed through the use of the long range questionnaire disclosed that such a step would create more problems than it would solve. Analysis of their needs indicated that the solution to the problem lay in integrated data processing. Analysis of the complexity of products, plant locations and capacities and projected order volume, dictated the decision to utilize mechanical data processing equipment. Electronic data processing was deemed to be impracticable for the foreseeable future. The completed system must not only be capable of rapid, accurate and economical operation, but must also provide for immediate assimilation of additional manufacturing plants in outlying locations.

While ultimate coverage will not be fully completed for the next two years, they are in a position to develop all its details with adequate provisions for every phase of operation based on requirements disclosed through long range forecasting.

Punched Tape

The basis for processing all data embodies the use of the standard five channel punched tape. This enables the utilization of tape punching–tape reading office machines, as well as commercial facilities for long distance data transmission.

At the moment, they are designing forms for integrated and automatic order, shipping and invoice preparation. They are providing for selective programming of data for mechanical preparation of various sales, production and accounting reports and analyses.

These illustrations typify the manner in which you too can evaluate past and present experiences and project them to predict the future. In this way, you will be able to establish sound systems and procedures to enable the attainment of management's objectives.

In summarizing, then, we have outlined: the principles of long range planning for systems; its application in systems programs; and some of the advantages possible should you want to consider similar development and application in your company.

So there is no misunderstanding about long range systems planning, bear in mind that the questionnaire is not a "cure-all" to be applied in liberal doses to any or all of your systems problems. It will not, for example, resolve the practicability of mechanical versus manual methods of operation; nor will it alter in any way the methodical and painstaking study required in any systems project. **s/p/a**

Messages must flow among men if business is to be done

Men, Messages and Means

► Men, messages and means are the basic factors with which we deal in systems and procedures work in business.

Did you ever ask yourself what it is 'to do business'? First you have to have men—used in the generic sense and including women. Take away the people and there's no business left. The moment these men begin to do business of any kind, they must at least begin to understand each other, they must communicate with each other, in one way or another they must send and receive messages.

To grasp the importance of messages, visualize the situation created in any business if the chain of messages forming the communications system is broken at any point. It is a sure-thing bet that operations beyond that point will come to a halt.

Some time ago, for example, one of our factories experienced a severe flood. When the waters subsided and the factory was cleaned up and machinery put in running order, we found that little could be accomplished until the communication system was re-established, until men could send and receive messages containing information which guided operations.

Messages must flow among men if business is to be done. Suppose one of you and I decide to do business with each other. The more clearly we picture in our minds our respective expectations of the transaction, the more accurately we reach mutual understanding of our agreement and the more conscientiously we perform the obligations we assume; the more satisfactory the deal will be for both of us. To do this, communications must be good.

At this point I'd like to give you a possible definition of the field of systems and procedures. Systems and procedures consists of men designing necessary messages and seeing that the means of transmission are those most suitable to get the messages to their destinations. Here we have men, messages and means.

Someone else has defined systems and procedures as a state of mind. I like the idea that appears to be behind this definition. It seems to me to say that systems and procedures ability is only where you find it. If we let our minds run over the people we've known in the business, some have abilities which we can recognize as helpful in systems and procedures work and others do not. It doesn't make too much difference whether an individual is actively

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by W. C. Meyer

in the field or not. If his state of mind is right, he's a systems and procedures man, at least in nature. The higher up in our organizations we find these abilities, or at least an understanding of them, the better off we are. I don't mean the management man who gives lip service to the idea of "cutting clerical costs," but the executive whose eyes light up when he sees the right answer to a systems problem. If you have men like that on your management team, your path is easier. But anywhere we find these abilities they are valuable.

Systems and procedures ability may not be dissected without destroying it. The whole may be greater than the sum of its parts. Let's look at a few of the parts.

First may I suggest that good systems and procedures men are characterized by selflessness? I mean the kind of selflessness which operates on the principle, quoting Mr. Percy, head of Bell & Howell, "That there's no limit to the amount one can accomplish if he doesn't care who gets the credit." To my mind this means a sincere willingness to give credit where credit is due, and to avoid, in so far as humanly possible, grasping for personal credit; rather, using the time and effort for accomplishment. Such an attitude frees the mind of the individual for positive thinking and even more important conveys to the minds of others the incentive to work in the same way, so that the individual's effectiveness is multiplied. If you can succeed in winning the cooperation of those with whom you are working on systems and procedures you are a long way on the road to a sucessful program.

We have also to guard against giving credit where it is not due. In my opinion this is unsound in the long run. Genuine selflessness is the aim.

Second, and closely akin to selflessness is dependence on the other fellow. By this I mean the quality of mind which is willing to depend on other members of the organization to do their jobs. I do not mean to forego systems and procedures analysis; rather in setting up systems and procedures to do so with the principle of dependence on the other fellow in mind.

You may have seen situations where two departments check on each other and actually keep duplicate sets of records in order that one department can make sure the other is doing its job. I had an experience in one of our subsidiaries where the sales department received daily shipment reports to make sure the traffic department was doing its job of delivery. Wouldn't it have made similar sense for the traffic department to have checked on the sales department to make sure the sales department was selling properly? We eliminated the daily report with no harmful result.

It would appear better in such cases to depend on the one department to do the job. If a spot audit appears necessary, this would be preferable to duplicating the effort. Nothing breeds inefficiency in an organization like everyone checking on everyone else. So if a project indicates that it puts dependence on an individual or organization unit to do its job well, it is directionally right, within auditing limits.

Third, clear objectives are characteristic of the men we're discussing. The prize of clear objectives is not easily won.

When I was in England as comptroller

continued

of our subsidiary there, the key men in the comptroller's division put themselves through the rigors of coming up with simple, clear objectives. These are the ones developed after much thought, accumulating ideas and opinions and stripping out the non-essential:

Comptroller: *To keep management together in their financial thinking about the company.*

Chief Accountant: *To report financially where the company has been.*

Forecasting Manager: *To report financially where the company is and where it will be up to three years in the future.*

Internal Auditor: *To help to make it easy for people to do things right and hard for them to do wrong things.*

We tested and checked these objectives in the fires of daily operation and found them good. The point is that any manager or systems and procedures man who puts himself through the mental discipline of coming up with simple, clear objectives will find the result worth the effort. He'll find a framework which gives him direction.

Last is constructive imagination. By this I mean the ability when confronted with a problem to find a way through it, around it or over it, the quality of mind which will not rest until the problem is solved. Alternately we could call this plain horse sense. Whatever you call it, it's the thing which, when you're surrounded with all the facts you can find, acts like a spark to ignite the solution to your problem. It's the catalyst which brings the other qualities to usefulness.

So our man is characterized by:

Selflessness—*an ability to keep his eye only on the ball.*

Dependence *on the other fellow.*

Clear objectives *established through perseverance.*

Constructive imagination *or plain horse sense.*

Can we find any principles which should characterize the messages? The first principle might be termed elimination. The message should be tested to see if it should be sent at all. The question asked is, "What basic cause makes this message necessary?" A search for this basic cause often will result in recognition of the fact that the message need not be sent and all attendant work can be eliminated.

I'm sure that most of you have worked with this 'basic cause' question. If you haven't, it's disarmingly simple. Try it by, say, writing on each page of your instructions for clerical procedures, "If it weren't for . . . (name the basic cause) this form could be eliminated". You'll be gratified at how much of the chaff will be blown away. Or try it on each report as it flows over your desk. You'll be surprised how many unnecessary messages are being sent. This is one aspect of systems and procedures work which is explained easily to supervision and which will pay the greatest dividends if your organization is one where it has not been done.

Second is the principle of good timing. Quick information just within the desired limits of accuracy is better than slow information well within the desired limits.

When Mr. Patterson was president of National Cash Register, a cost accounting system was installed. Trouble was it took weeks to get information out of the department. One day Mr. Patterson went to the department, told the bookkeepers to pick up their ledgers and follow him. Arrived at the boiler house he asked the foreman if the boilers could burn the ledgers. Receiving an affirmative answer, he had each clerk throw his ledger in the boiler. The messages had been too slow to be of any use.

I was in on a problem recently where original estimates of comparative costs indicated only one possible answer. We were able to give the comptroller this answer

shortly before an administrative committee meeting. I'm not sure the subect was discussed, but if it was, he was in much better shape to talk than if we'd waited for the final finished report which followed later. Our messages should be prepared with the principle of good timing in mind to be most effective.

The third principle for messages is that of review. Just before passing data on to be used, we should ask ourselves the question, "Based on my knowledge of the problem does this information look right?"

There is a tendency, born of desire to get information to management as quickly as possible, to hit the answer on a machine and run for the boss' office. If you can, squelch that first impulse. It will save your firm time and money if you take time to review and include in your systems and procedures work time for others to do likewise. I made an estimate once that possibly 30% of clerical time is used up in effort caused by errors. That's a debatable figure, but the figure is a substantial one. It is small compared to the harm done if management acts on incorrect information. A vein to work in this regard is the development of short-cuts which eliminate detailed checking.

So our messages must:

Pass the test of possible elimination.

Be well-timed or apt.

Be accurate.

What about possible principles involving the means of transmission? The first principle was used originally by the armed services. It is the principle of calculated risk. Applied to clerical work this principle is stated "if the cost of doing the work is greater than the probable harm to the business should the work not be done, don't do the work." You deliberately swallow small losses in the application of this principle. A clear example of this principle is the checking of seller's invoice extensions and totals. There is a value of invoice below which the cost of checking outweighs savings in errors found. We have one person doing what amounts to a spot audit of these invoices where three to four people would be necessary to do the job completely. On occasion we check all invoices to make sure we're getting a good sample. The work done on the message must answer for itself in the scale of calculated risk.

Second is the principle of economy of effort. The aim here is to transmit the message with the least expenditure of resources—men, money and materials. We should try to do this, not by driving people, but by careful selection of the means of transmission.

One of the draw-backs we face in paperwork is what amounts to man's near reverence for paper. You undoubtedly teach your children to handle books with care. It we go back in man's history this is understandable. Man's earliest existing written record consists of two limestone tablets about 5,000 years old from the kingdom of Sumer in the Tigris-Euphrates valley. One contains characters and figures and is acknowledged as a bookkeeping entry. The other records the description of two parcels of land. Some 2,000 years later papyrus and ink were invented in Egypt. The transmission of facts and thoughts between generations in exact form became possible. When the printing press was invented in the 15th century, man took a tremendous stride forward because knowledge could become widespread. So we rightly stand somewhat in awe of paper.

To do a good systems job in business we must overcome our reverence for paper. The important point is for the message to flow. Maybe a telephone call will do the job. Maybe the individual is close enough so we can pass the message on verbally. Maybe the message has to be written. Whatever the means of transmission it should be only enough to get the message across.

continued

The third and final principle is that of flexibility. Here, I am thinking about keeping up with changes in the messages. If any fact or probability becomes apparent which might change management's thinking, our communications system must be such that it can quickly pass this information on.

We have studied our communications system to make it as reponsive as possible. We have found that duplicating processes are fast, accurate and flexible, and constitute a real help in keeping the means of communication free to function effectively. On our P&L and Cash forecasts, for example, management accepts the forecast portion of the necessary form in handwriting. Since the forms are printed on tracing paper, the figures can be changed and reproduced far more quickly than if typed documents were used.

Thus the means should be looked at with these principles in mind: calculated risk, economy of effort, and flexibility.

What does this all add up to? What I've tried to do is suggest some nuclei (there are certainly others) around which our ideas and thoughts can coalesce in the future to give us some guideposts in the field of systems and procedures endeavor.

To recapitulate, here are the nuclei which, so far, seem important to me:

Men characterized by selflessness, willingness to depend on the other fellow, clear objectives, constructive imagination; *Messages* tested for possible elimination, furnished with good timing, reviewed for aptness; and *Means* weighed in the scales of calculated risk, checked for economy of effort, flexible to meet the needs of the business.

If we have such men on our systems and procedures work and if we keep the principles I have suggested in mind as guideposts for their efforts, we shall have taken strides that are directionally right towards keeping our company doing business on a sound basis. **s/p/a**

Concepts of A

► Administrative services, or administrative management, is a recognized specialty in many business firms today, and enjoys a great deal of prestige. The Vice-President-Administration, often schooled and experienced in the traditional field of office management, is developing a kind of standard identity on a high management level which enables him to provide an effective staff to provide administrative management to all departments and divisions.

What can colleges and universities do to help bring about more and better administrative management? I think prestige of the field would be enhanced if shorthand, typing, bookkeeping, adding machine operation and the like were taken out of the field of office management, and emphasis placed on the administrative, rather than purely office routine area.

This concept of administrative management is not a vocational thing at all, it is management in the highest staff connotation. The management aspects, then, should be bolstered, and a unity provided.

Dynamic Field

What should be included in the study and in the practice of administrative management? The field is extremely dynamic now, and no hard-and-fast limits of content can be set, but here are some of the jobs that are frequently unified under the administrative manager:

Organization Planing and Control
Communications—Wire, Mail, etc.
Work Simplification
Forms and Supplies Control
Procedure Manual Control

# of Administrative Management

Management Information Preparation and Control
Systems Analysis
Lateral Coordination of Policies and Practices
Reproduction—Printing, Photo, etc.
Records Management
Stenographic Service Groups
Reports Control
Office Equipment Analysis and Control
Electronic Data Processing Program Planning
Operations Research Activities
Overhead Cost Control

The Challenge

There are more but these comprise the largest area of work now in actual practice. The challenge of such an imposing management package is obvious indeed; it is up to all of us in office management both in schools and in business to prepare to meet this challenge.

Meanwhile, before administrative management attains this highly idealized state, what can we do to enhance the field immediately? We are familiar with the problem of communications in industry today. This is an immediate problem and it is a real problem. It occurs to me that the specialists who come the closest to these ways of treating directly with this matter of communications are the systems and procedures people. Systems and procedures very definitely belongs not in the accounting or engineering areas, but within the framework of the administrative services division. I would suggest that the very first thing an office manager should do to begin the trend toward real administrative staff management is to gather up all of the isolated systems and procedures activity and centralize it within the administrative services organization. If he will then recognize that the focal point of systems and procedures activity is in the area of communications, he will provide a real administrative service and will enhance his position quite immediately. Now there is a tremendous body of work and study in this area of better communications through systems analysis, much too large a body to explore fully here. But we can recognize that there is a definite trend for systems people to move from the various organizations where they are found into administrative services. There is a coincident trend for these people to depend for the content of systems on the line people responsible for doing various jobs. The modern systems analyst is coming more and more around to the concept that he is more a communicator of ideas than a creator of ideas.

Formalizing and opening up better lines of communications through forms control, procedures issuance and control, and systems analysis, all centralized in the administrative management area will in itself provide an effective vehicle for effective administrative staff work. What's more, it will open the door to further development of this field into many other areas of scientific administrative management.

(Excerpts from a talk by William C. Gill, Douglas Aircraft Co., Tulsa, Okla. at the University of Michigan School of Business Administration Alumni Conference, May 11, 1957. Edited by R. Fraham.

Inter-company, inter-industry exchange of business data in the form of machine language will result in substantial dollar savings

The Coming Revolution i

► The major part of the total volume of routine data in industry is communicated by means of printed business forms. While some of this steady flow of paper is generated to enable us to accomplish *internal* communications among the various departments of our company, the balance of this vast stream of business forms is designed to transmit data *externally*, largely between the vendor and the customer.

While at present practically all of the incoming data has to be encoded manually and converted to machine language prior to being processed electronically, there are some hopeful signs that in the not too distant future much of this manual conversion to machine language might be automated. Optical and magnetic character sensing seem to be the most encouraging methods promising some relief in the fields of raw data origination, and conversion from human language to machine language. However, a great deal of systems and forms standardization in industry will have to precede any large-scale applications of this automatic encoding and conversion.

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The sequence of information as well as the positioning of certain data would have to be standardized largely on Purchase and Sales Order Forms in order to make it feasible to employ character sensing devices that would convert human to machine language. While it is one thing to standardize our own company's forms over which we have complete design control (such as purchase order, invoice, or check forms), it is quite another story when we try to standardize other companies' forms, (such as the variety of purchase order, invoice and check forms) that are sent in to us. However, it is just this kind of large-scale forms standardization that is required to eliminate costly manual data origination.

The forms standardization program that is envisioned here would require the sort of universal effort that many years ago resulted in a "Universal Bill of Lading". The potential rewards in terms of dollar savings that must result from such a successful industry-wide program are sufficiently large to warrant a considerable effort on the part of "Management Scientists" and Systems and Procedures Managers.

This concept would involve a truly inter-industry, inter-company integrated data processing program which would result in

by Rudolf Borchardt

n in Information Handling

the interchange of business data in the form of machine language. Information would be "printed out" in human language only when an exceptional occurrence requires human judgement to satisfy the situation.

Business forms printed in human language and simultaneously coded in machine language (perhaps by means of magnetic spot coding) would represent an intermediate stage before we could hope to reach the goal of eliminating business forms in human language altogether. Even this intermediate stage would tend to reduce the present volume of business forms in industry. The eventual goal would be, to have computers, located on the premises of different companies, converse with each other "On-Line". This might involve transmitting order information from Company "A" to Company "B" and then by reversing the communications flow transmitting a series of invoices for accomplished shipments, from Company "B" to Company "A".

This type of concept is not really as "Blue Sky" as some people would like to think. Even today, in some of our service industries plans are afoot along similar lines.

Recently, several railroads decided to interconnect their electronic Pullman Reservation System so that a ticket agent at any one point on any one of the lines would have access to the Pullman space inventory of the combined rail network. Plans are in the discussion stage to interconnect electronic reservations systems for several of the larger airlines in this country to operate in similar fashion.

Another plan presently in the design stage involves interconnecting several of the major brokerage houses with a computer, located at the New York Stock Exchange. Such a proposed system would enable this nation's brokers to execute their customers' orders "On-Line" automatically.

Still another example of this kind of planned data interchange can be cited in the case of the American banking system. The committee on Mechanization of Check Handling organized by the American Bankers Association has pretty well finalized plans for a standardized bank check which would be printed in both human and magnetic language. Eventually this would enable the entire banking system of the United States to automate check handling procedures.

It is probably the plan for automated check handling that will most likely promote the concept of standardized business forms for all of industry. It can be predicted with some certainty that while the clerical burden involving checking account operation will be eased considerably through this type of automation, some of

continued

the larger commercial checking account customers will undoubtedly take advantage of these magnetized checks to automate their own bank account reconciliations. Once the large-scale standardization of check handling has been accomplished, it is safe to assume that a check-voucher in machine language will not lag far behind the magnetized bank check. A magnetized invoice as an extension to the magnetized check-voucher principle is not too difficult to envision. Soon, thereafter, sales order and purchase order forms would become standardized and be printed in machine language.

Before too many years have passed, it would then seem quite reasonable to expect that all business forms serving the interchange of data between companies would perhaps be printed in both intelligible human as well as unintelligible machine language. It can be envisioned further that eventually those firms whose computers can accept forms in machine language on a routine basis, would then no longer have any need for human language on any of the business forms received from other companies. At that point routine inter-company data exchange in machine language will become the order of the day.

At present, at least two applications of inter-company business data interchange exist in the form of a common machine language:

Recently the General Electric Company and even more recently Con Edison were cited as being the only companies so far, to send Form 941 data on magnetic tape to the proper government agency. This involves the submission of quarterly reports by employers of wages taxable under the Federal Insurance Contributions Act. It was stated that the government agency involved is now encouraging other firms to submit their data on magnetic tape as well.

At the Ninth International Systems Meeting held at Philadelphia in October of 1956, one of the several industry seminars, "Basic Iron and Steel", dealt with the topic of inter-company systems cooperation. During this seminar, it was stated that punched cards had replaced purchase order forms in the business activity taking place between Westinghouse Air Brake and the Western Maryland Railroad. It was further stated that invoice forms would also be replaced by punched cards in the near future.

The kind of business systems and forms standardization that must have preceded these two successful examples of inter-company business data exchange in machine language will be required of all American industry, if this type of data exchange is to be developed on a national basis. The task of intra- as well as inter-industry systems cooperation will have to be undertaken by trade associations on the one hand, and by professional groups like the Systems and Procedures Association, and the Institute of Management Sciences on the other.

To develop this type of program, it is suggested that concentration be largely directed towards the following areas:

1. Standardization of material specifications within each industry.
2. Agreement on and publication of glossaries of standard terminology for each industry.
3. Uniform sequences of information as well as positioning of data on routine business forms, such as purchase orders, invoices, etc. First, on an intra-, then on an inter-industry basis, eventually resulting in standardized business forms for all of industry.
4. Standardization on one universal machine language for business data interchange.

Before we can hope to succeed in standardizing business systems and forms on an inter-industry basis, it should be recognized that a very thorough understanding

of each industry's problems is the most basic requirement. Probably this understanding could best be gained by establishing a special research group within each industry, organized along the lines of the American Bankers Association's Committee on Mechanization of Check Handling. For a period of one or two years, each of these groups would meet perhaps two days each quarter to define mutual intra-industry problems, with a goal of standardization of forms, systems and procedures within that particular industry. Eventually, it is envisioned, that combined inter-industry meetings would be held among these groups to discuss inter-industry systems cooperation especially when two or more of these industries carry on a large volume of routine transactions with each other.

It is to be hoped that by perhaps 1960 a good start might have been made towards inter-company exchange of business data in machine language on an inter-industry basis. This would involve the inter-company exchange of punched cards, perforated tapes, magnetic tapes, etc. If progress were to continue at an accelerated pace, it might then be predicted that by 1961 or 1962 inter-industry systems standardizations may have reached a point where a considerable number of the larger companies in diverse industries will have commenced to exchange business data in machine language. When this stage has been reached, it might become practical to establish telegraphic connections between computers located on the premises of different companies to exchange business data in "On-Line" fashion.

In summary, it should be stated, that business systems standardization must precede inter-company exchange of business data in machine language, and that in turn, intra-industry systems cooperation must precede such inter-industry applications, if we are to proceed with a national business data standardization program. **s/p/a**

Worth Reading

"They Saved Eight Days of Shutdown"
Harry J. Mitchell, *Modern Office Procedures,* March 1957.
Describes how General Aircraft Supply uses photographs of visible index trays in their inventory process. Previously ten days were needed for the inventory; now only two are required. About 15,000 parts are involved.

"They Hurdled the High Cost of Small Orders"
Hiland W. Hall, *Modern Office Procedures,* May 1957.
A firm sending 1200 invoices monthly decided to use punched cards to reduce the cost of handling small orders. About half of their orders are under $10. A detailed description of the procedure is given.

"How to Make Your Forms Simple, Effective, Economical"
George Biek, *Office Management,* March 1957.
Presents many practical suggestions on design and reproduction of forms. Covers equipment needs, paper choice and design requirements stemming from the reproduction process.

"The Programming of on Office Computer"
Walter R. Mason, *The Office,* April 1957.
Describes in detail how an actual program is written. Uses 700 words to explain how two figures are added in

continued

Worth Reading

a segment from a payroll program. Includes an explanation of binary numbers and the address system used in computers.

"Better Tables and Graphs for Stronger Reports"
Morris Rudin, *NACA Bulletin,* April 1957.
Illustrated discussion of the principal types of tables and graphs. Best uses for each type are suggested.

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1 **"The Necessity of Electronic Thinking"** B. E. Wynne
2 **"Electronic Computer—Threat and Opportunity"** F. S. Howell
3 **"From Punched Cards to Computer"** J. W. Schrey
4 **"Processing Our Payroll on the IBM 650"** M. E. Sterling
5 **"Processing Our Payroll on The UNIVAC"** T. E. Aiken
NACA Bulletin, May 1957.
Articles 1 & 2 are primarily an introduction to the field. Punched tape language is discussed in detail. Article 3 describes Magnavox Company's experience in a general way. Articles 4 and 5 are detailed illustrated descriptions of procedure.

"How a Machinery Company Redesigned Its Accounting System"
Milton R. Kubik, *Office Executive,* April 1957.
Illustrated description of how a machine accounting system was changed so that the number of machines was reduced from six to four and personnel reduced from seven to four. The company generates 3500 accounts payable entries a month and 5000 distribution entries. These are posted to 3000 expense accounts and 200 general ledger accounts. The cost system generates 1000 entries a day posted to 2000 assembly and lot cards.

"Practical Pitfalls to Guard Against in Electronic Data Processing"
Ben Conway, *Office Management,* April 1957.
Discusses problems arising from the following aspects of establishing a computer system for a public utility: (1) Selecting personnel; (2) Preparing Meter Reading Cards; (3) Creating customer master tapes; (4) Preparing the billing program.

"Inventory is Kept More Accurately and Cheaper by Bookkeeping Machines"
J. H. Leach, *The Office,* April 1957.
Three bookkeeping machines are used by the Upjohn Company for inventory records which required four persons in a manual system. A ledger card is maintained for each part and for each Department using a part. About 35,000 postings are made monthly to 3000 cards.

"The Real Red Menace"
Harry H. Fite, *The Office,* May 1957.
Humorous treatment of the causes of excess paperwork. Elaborates on the following "states of mind", among others: The Cosigner, Let's Not Fight The Problem, Gosh—Did I Forget To Tell You, Let George Do It, Do It Yourself, Don't be Half-Safe.

"How to Systematize The Selection and Buying of Office Equipment"
Office Management, May 1957.
Describes the office equipment program of the Home Life Insurance Company. The program consists of 1) evaluations of demonstrations of equipment 2) comparison tests of new items against similar items in use 3) detailed filing system for literature on equip-

ment. The program does not include electronic and punched card equipment.

"Systems Planning for Computer Application"

Howard S. Levin, *The Controller,* April 1957.

Describes important aspects of the following major phases of the evolution of a computer system: 1. Analyzing present processes and determining basic needs. 2. Developing new system requirements and selecting equipment. 3. Implementing the new system.

"Punched Card Systems Don't Have to be Expensive"

Richard Neumaier, *The Office,* May 1957.

Summary descriptions of the following systems using minimum tab equipment: Community Nursing Service Statistics, Inventory Control, Inventory Forecasting, Sales Analysis. Equipment used ranges from a self-interpreting punch to a combination of key punch, sorter and accounting machine. In some cases service bureaus were used. The author offers further details upon request to *The Office.*

"Keeping Up With Price List Changes"

L. A. Gowdy, *Modern Office Procedures,* March 1957.

Describes International Harvester's conversion from manual to tab machine preparation of price lists. Time required to publish the list was reduced from 4 month to 4 weeks. About 200,000 parts are involved.

"How We Cut Record Posting Time Ten Days"

John B. Scott, *Office Management,* May 1957.

Describes the IDP system of a furniture manufacturer with 22 warehouses throughout the country. The following equipment is used: 1) leased wires 2) tape producing teletypes 3) tape reperforator 4) tape to card converter. Records are posted in 2 days instead of ten. A ten part form was replaced.

"Work Measurement"

D. A. Stivers, *Modern Office Procedures,* February 1957.

Describes the work measurement program of the Mutual Benefit Health and Accident Association. Its prime purpose is to make it possible to handle peak loads without disturbing the normal routine. This was done by estimating personnel requirements according to department work loads and by creating an exchange group of personnel.

"Advantages of Centralized Filing"

Dorothy S. Knight, *Office Executive,* January 1957.

Describes Lever Brothers' centralized filing system. Two thousand file drawers of material are maintained at 1 general file station and 20 decentralized stations in the same building. Each month 250,000 documents are filed and 15,000 references are made. To assure prompt action on requests for data a conveyor system is used which makes a complete circuit of the building every 8 minutes.

"Three Computers Speed Data Flow at Metropolitan Life"

Frederick Vogel, *Office Management,* February 1957.

Summary of applications placed on three Univac computers at Metropolitan Life. About 900,000 policy transactions are processed by the computers each month. More than 550 different programs have been prepared. Over 100 persons are involved in their Electronic Installations Division.

Book Reviews

Introduction to Operations Research, *by C. W. Churchman, R. L. Ackoff and E. L. Arnoff, John Wiley & Sons, Inc., 440 Fourth Ave., New York, 655 pp., $12.00.*

As the title indicates this book is an introduction to operations research. It covers the subject well, one step at a time. In addition to lucid explanations it presents case problems and formulae. This text is recommended for the initiate in operations research.

While portions of the book are somewhat technical one can follow it easily. The authors developed the material from the original lectures on operations research as presented at the Case Institute of Technology.

A common conception of O.R. is that it deals with an overall problem. The authors do not fully agree with this—quoting from the book:

"The systems approach to problems does not mean that the most generally formulated problem must be solved in one research project. However desirable this may be, it is seldom possible to realize it in practice. In practice, parts of the total problem are usually solved in sequence. In many cases the total problem cannot be formulated in advance but the solution of one phase of it helps define the next phase."

Of particular interest to systems analysts is the definition of this new field:

"O. R. is the application of scientific methods, techniques, and tools to problems involving the operations of a system so as to provide those in control of the system with optimum solutions to the problems."

In addition to a discussion on each of the various phases of O. R., the last chapter covers the selection, training and organization for operations research. Each chapter has its own bibliography.

Automation in Business and Industry, *edited by Eugene M. Grabbe, John Wiley & Sons, 440 Fourth Ave., New York, 630 pp., $10.00.*

A series of lectures on automation form the basis for the book. The lectures were presented at the University of California in Los Angeles by prominent engineers and scientists.

The book covers a wide range of subjects in the automation field. Some of the chapter titles are Feedback Control Systems, Basic Concepts of Industrial Instrumentation and Control, Analog Computers, Digital Computers, Data Processing, Manufacturing Automation and Economies of Plant Automation. Charts, diagrams and photographs illustrate the subject matter.

Each of the twenty-one authors has reviewed automation developments in his special field with liberal use of examples. By including many contributors, a broad coverage has been attained. Although the treatment is general rather than technical, much highly detailed information is given.

Industrial Organization and Management, *by Lawrence L. Bethel, Franklin S. Atwater, George H. E. Smith, and Harvey A. Stackman, Jr., published by McGraw-Hill Book Company, Inc., N. Y. 719 pages, price $6.75.*

While this book is essentially a text for instructional purposes, it can also serve as a ready reference in the executive or management engineer's library for information on specific areas of industrial organization and management. It covers major phases of management production, employee relations, personnel management, industrial engineering, budgeting, etc.

Some chapters of particular interest to the systems man are those on time study, quality control, production control and methods analysis. Particularly noteworthy is the book's 22 page bibliography of books, articles and visual aids.

Systems---After the Fact

Most systems men agree that the best way to conduct a procedures survey is to outline the scope and objectives, draft a plan of action, and establish a completion date. To do otherwise would be an anathema to the profession. Yet here at Convair-San Diego, we are doing exactly this.

The procedures group of the Engineering Department is assigned, among other things, to develop and install operating procedures. These procedures are published as Engineering Department Instructions and are inserted in a loose-leaf binder which is called the "EDI" Manual. The manual is distributed to all levels of supervision for information, guidance, and compliance.

Anyone in the Engineering Department can request that an EDI be published for dissemination. When this happens, the procedures group is contacted and an analyst is assigned to the job. The proposed EDI is discussed with the person and supervisor concerned. The requester is asked to submit a rough draft of the proposed EDI to the analyst. The draft is reviewed, researched, and rewritten into the proper style and format. The revised draft is forwarded to the requester for further review, comment, and/or coordination. When this is completed, the analyst reviews the draft again for further revisions, if any, and gives the draft to the typist for typing onto a duplimat. The duplimat is reproduced, and sufficient copies are run off for distribution to all levels of supervision for insertion in the manual. The EDI now becomes official.

This is what we call "Systems—After the Fact" approach. It now falls upon the supervisors concerned to call the new EDI to the attention of their respective personnel. No attempt is made to conduct a full-scale survey. Neither is an attempt made to sell the proposed procedures to the operating activity. Their supervisors have already approved the proposed EDI.

The advantages derived from this approach are man-hour savings in that the time of the analyst and the operating people are not taken unnecessarily. This also makes for better staff-line relationships since the operations are not interrupted by staff visits. It also strengthens supervision as responsibility is placed upon it for adopting and installing the procedure. Accountability is also pin-pointed as the supervisor is responsible for insuring compliance since he is the one who develops the procedure while the analyst serves merely as a catalytic force to formalize the EDI.

The observations made here are that it is impossible to set forth accurately the exact working procedure to be followed by a systems man. It depends on management and organizational climate. Each approach must be treated individually according to the known variable factors and the ingenuity of the systems man.—By Lem F. Thom, *Convair-San Diego, Calif.* **s/p/a**

On Systems Education

BEYOND A FEW COURSES in such fields as office management, business administration and accounting systems, the college curricula of the thirties and forties offered little to whet the professional interest of the prospective systems analyst. But as we move into the late fifties, with a growing awareness of the huge size of our clerical work force and the looming image of the automatic office, the tide has been running strongly toward the enlargement of systems education in the colleges and in special programs and seminars. The demand has been created by those already established in systems work who want to broaden their backgrounds, and by business executives looking for better basic training in the thousands of young men and women they hire each year to handle systems work.

Even so, the development of systems curricula in colleges may still be described as quite "spotty". Most systems courses are offered as electives, and few colleges have recognized "Systems and Procedures" as a specialized field consisting of a well-rounded course of study in techniques and related disciplines as prerequisites to a degree in this field.

The need for a better definition of the systems curriculum was pointed up at the Round Table on Systems Education held in conjunction with SPA's International Systems Meeting in Philadelphia last year. To fill the yawning gap which was revealed in the discussion of the subject by representatives of more than a score of universities, institutes and business groups, SPA through its national education committee, headed by William B. Worthington, is mapping out a detailed "Systems Institute" program consisting of 34 major systems education topics which can serve as starting points in defining the content of specific courses. Most of these topics have been assigned to one or more individuals to work out, and some preliminary write-ups have already been circulated within SPA. It appears certain that, as a result of these efforts, the second Round Table on Systems Education, to be held at the time of the next International Systems Meeting in Los Angeles next October, will find much of the groundwork already laid to enable it to take decisive action in stimulating some rapid and far-reaching developments in the field of systems education.

THE EDITORS

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ALBANY
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